



# EVALUATING OPTIONS FOR ENHANCED RISK-ADJUSTED RETURNS

CBOE Russell 2000 Option Benchmark Suite and Case Studies on  
Fund Use of Options

## Introduction

The study analyzed four Chicago Board Options Exchange® (CBOE®) Russell 2000® Options Indexes: **CBOE Russell 2000 BuyWrite Index (BXR)**, **CBOE Russell 2000 30-Delta BuyWrite Index (BXR)**, **CBOE Russell 2000 PutWrite Index (PUTR)**, and **CBOE Russell 2000 Zero-Cost Spread Collar Index (CLLR)**. Additionally, targeted analysis was conducted on the CBOE Russell 2000 One-Week PutWrite Index (WPTR). All of the CBOE indexes are constructed through the use of options on the Russell 2000 Index (RUT), but they differ in terms of structure and performance. Case studies were also performed on the performance of funds and fund managers that utilize options in their investment strategies.

## Executive Summary

### HIGHLIGHTS OF OUR STUDY'S FINDINGS

With the exception of PUTR, the returns posted by most of the CBOE Russell 2000 options-based strategy indexes trailed the Russell 2000 Index over the course of the study, but did so with lower volatility.

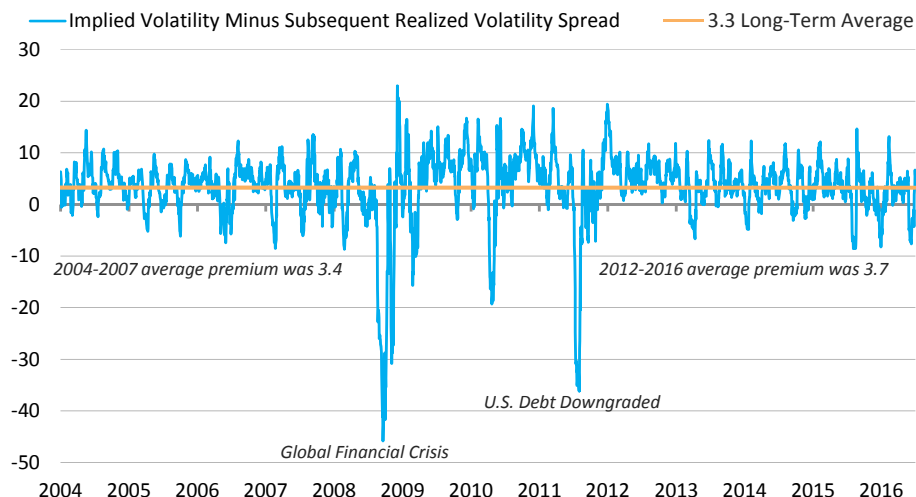
- **Outperformance:** Despite the massive U.S. stock market rally concurrent with this study, the performance of the PUTR exceeded that of the Russell 2000 Index.
- **Richly Priced Index Options:** The study found that there was a volatility risk premium for RUT options; implied volatility exceeded realized volatility by 3.3 volatility points. This premium helped facilitate strong risk-adjusted returns by the Russell 2000 Options Indexes.
- **Lower Volatility:** The CBOE Russell 2000 Options Indexes exhibited lower standard deviations and less severe maximum drawdowns than the underlying long-only equity index.
- **Enhanced Returns:** The inclusion of the PUTR in a stock/bond portfolio would have improved risk-adjusted returns.
- **Case Study on Options-Writing Mutual Funds:** Options-writing mutual funds, as a combined group, had less than half the volatility of the stock indexes studied.
- **Case Study on Buy-Write Strategies:** A group of institutionally-focused buy-write strategies outperformed buy-write indexes but trailed the long-only index during the recent 5-year bull market; they did so with comparable risk to the buy-write indexes and less risk relative to long-only equity benchmarks.
- **Case Study on Put-Write Strategies:** Institutional put-writing strategies, as a group, exhibited similar risk-reducing characteristics relative to the long-only equity indexes that were demonstrated by the PUTR relative to the Russell 2000 Index, recognizing that a limited number of managers and historical performance was available.

See appendix for detailed options index descriptions.

Implied volatility (as shown by the CBOE Russell 2000 Volatility Index [RVX]) minus the subsequent 1-month daily close-to-close realized volatility of the Russell 2000 Index.

From 2004 to 2007 the average premium was 3.4. From 2012 to 2016 the average premium was 3.7. Following the major events from 2008 through 2011, the risk premium became elevated relative to the long-term average.

### EXHIBIT 1: VOLATILITY RISK PREMIUM—DAILY



Data Sources: Bloomberg, CBOE; data from January 2004 to June 2016

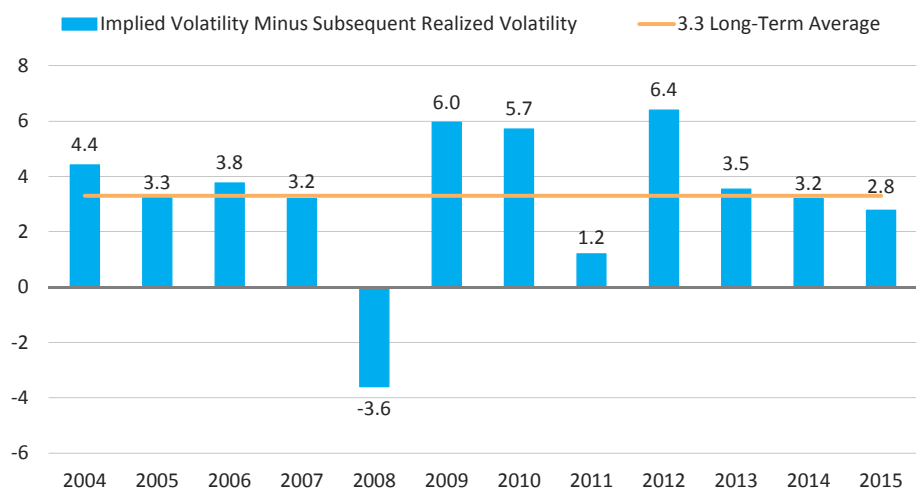
Since 2004, the estimated average difference between RVX Index implied volatility vs. Russell 2000 realized volatility of daily close-to-close was 3.3 volatility points. This means that the actual volatility experienced by the Russell 2000 Index was 3.3 points (annualized) lower for the 30 days following a reading of the RVX. This may cause options to be richly priced and offer potential reward to sellers of option premiums.

Additionally, researchers such as Bollen and Whaley<sup>1</sup> found that changes in implied volatility are directly related to net buying pressure from public order flow. Investor demand, most notably for the protection provided by the out-of-the-money (O-T-M) puts, may explain much of the volatility risk premium.

Annual averages (2004-2015) of the CBOE Russell 2000 Volatility Index (RVX) minus the subsequent 1-month realized volatility of the Russell 2000 Index.

Throughout time, the volatility implied by index options prices usually has exceeded the subsequent realized volatility of the related stock index.

### EXHIBIT 2: VOLATILITY RISK PREMIUM—CALENDAR YEAR



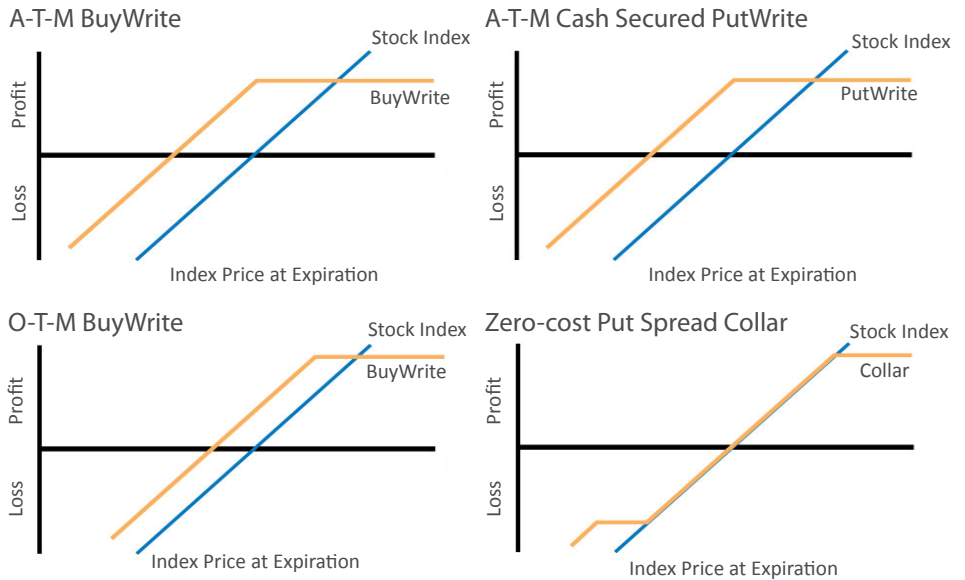
Data Sources: Bloomberg, CBOE; data from January 2004 to December 2015

<sup>1</sup> Nicolas P. B. Bollen and Robert E. Whaley, "Does Net Buying Pressure Affect the Shape of Implied Volatility Functions?", The Journal of Finance, Vol. LIX, No. 2, April, 2004.

Buy-write strategies generate income by writing call options. All else being equal, the at-the-money (A-T-M) version generates more income from call premium selling while the out-of-the-money (O-T-M) version more greatly participates in upside stock market moves.

An A-T-M secured put-write strategy generates income by selling put options, but does not participate in stock market advances beyond the amount of premium received. A zero-cost put spread collar exhibits market-like returns with both upside and downside moves truncated.

### EXHIBIT 3: PROFIT AND LOSS EXPECTATIONS

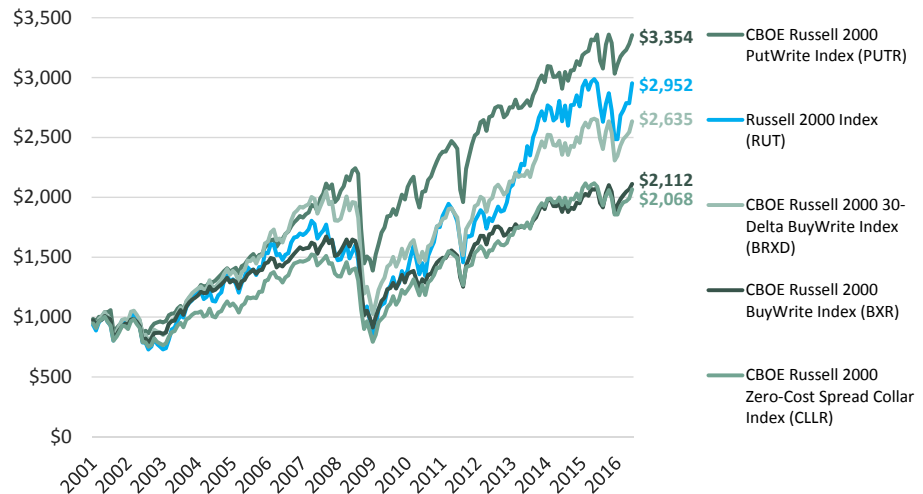


Source: CBOE

The prospective return (including reinvestment of dividends but pre-tax and gross of fees) of a \$1,000 investment initiated in each of the indexes beginning January 2001.

Despite a number of intra-period drawdowns, the CBOE Russell 2000 Options Indexes generally posted favorable returns over the course of study (January 2001 through July 2016).

### EXHIBIT 4: GROWTH OF \$1,000



Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

The period of study was a strong one for stock markets, yet the CBOE Russell 2000 PutWrite Index (PUTR) exhibited stronger performance relative to the long-only equity Russell 2000 Index. Although not immune to the volatility that befell most risky assets surrounding the credit crisis in 2008, the PUTR held up better than the Russell 2000 Index by declining 28.5% that year while the Russell 2000 dropped 33.8%.<sup>2</sup>

Not surprisingly, the CBOE Russell 2000 BuyWrite (BXR) and CBOE Zero-Cost Spread Collar (CLLR) Indexes posted positive returns, though not as strong as the Russell 2000. The characteristics of the CBOE Russell 2000 30-Delta BuyWrite Index (BRXD) allowed it to capture more of the market advances than the BXR that writes call options closer to the money.

All of the indexes in this paper (except the RVX Index) are total return indexes (pre-tax indexes that include reinvested dividends). Past performance is not predictive of future returns. Please read full disclosures on the last page of this paper.

<sup>2</sup> Bloomberg

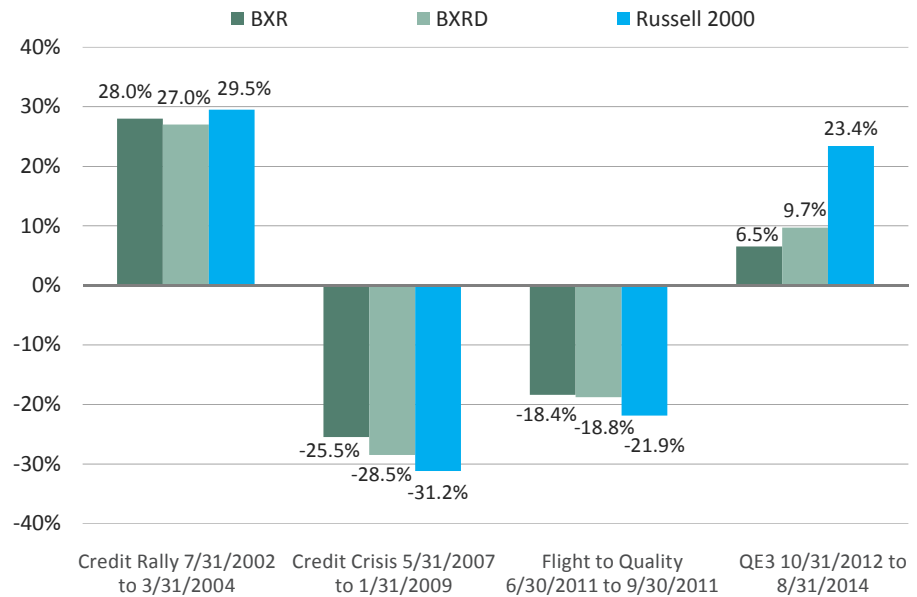
As a general rule, buy-write indexes have, and can be expected to, trail long-only equity indexes during extreme stock market rallies while participating less during large drawdowns.

Annualized returns during extreme market environments.

The CBOE Russell 2000 BuyWrite Index (BXR) and the CBOE Russell 2000 30-Delta BuyWrite Index (BXR) exhibited a more defensive pattern of returns in extreme down markets, holding up better than the Russell 2000 in both the Credit Crisis of 2007-2009 and the 2011 Flight to Quality.

QE3 is the Federal Reserve's third iteration of its quantitative easing bond-buying program.

EXHIBIT 5: RETURNS IN EXTREME MARKET CONDITIONS



Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

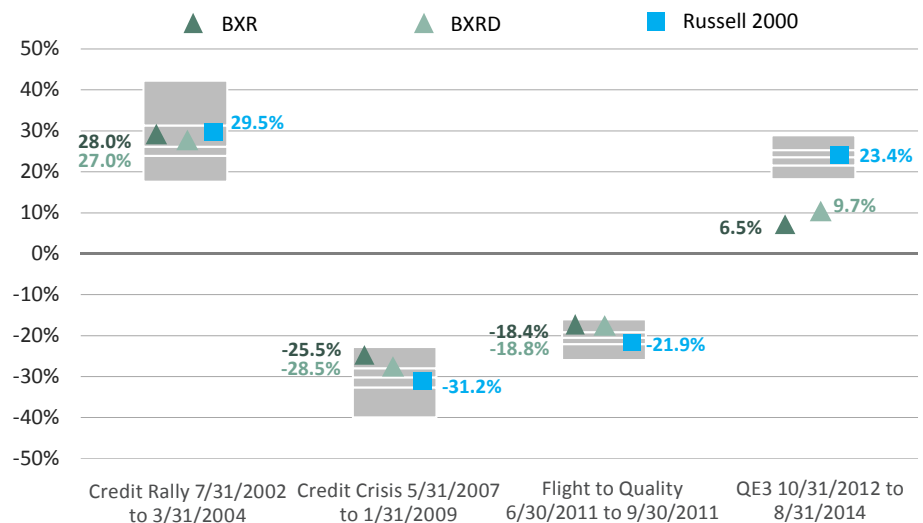
One potential reason that the buy-write indexes trailed the long-only equity index by a larger amount during QE3 than the credit rally of 2002 through 2004 was the difference in option premium pricing. From August 2002 through March 2004, the average level of the CBOE Volatility Index® (VIX®) was 23.9 while it averaged only 14.8 from October 2012 through August 2014 (data for the CBOE Russell 2000 Volatility Index [RVX] is available since January 2004).<sup>3</sup>

U.S. small cap core universe quartile rankings during extreme market environments.

The average number of funds included in the universe over the period under consideration was 294.

The premiums received helped cushion the drops for both BXR and BXR.

EXHIBIT 6: UNIVERSE RANK IN EXTREME MARKET CONDITIONS

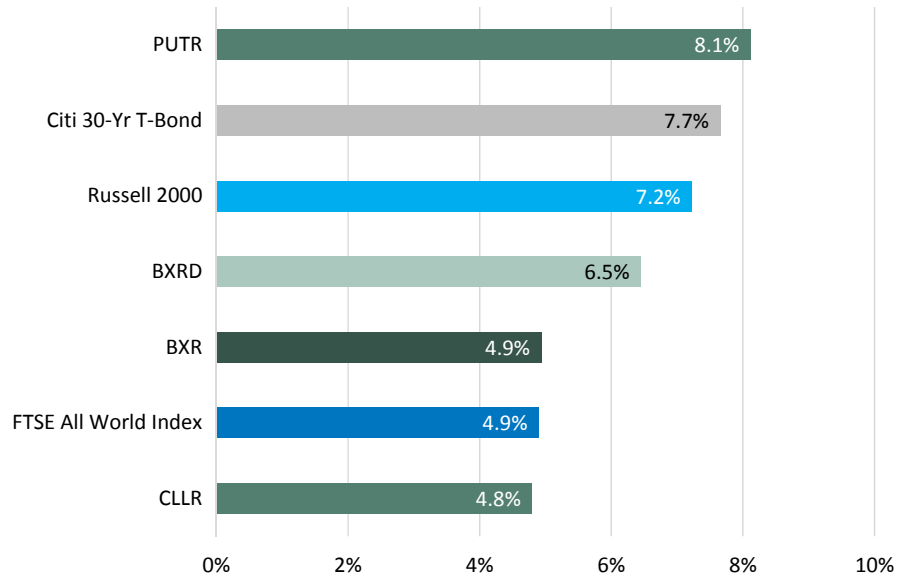


Data Sources: Bloomberg, Lipper, CBOE; data from January 31, 2001 to July 31, 2016. See full disclosures at the end of this paper.

<sup>3</sup> Bloomberg

Annualized returns of the CBOE Russell Options Indexes, Russell 2000, the FTSE All World Index and fixed income represented by the Citigroup 30-Year Treasury Bond Index. Data is from January 31, 2001 to July 31, 2016.

### EXHIBIT 7: ANNUALIZED RETURNS

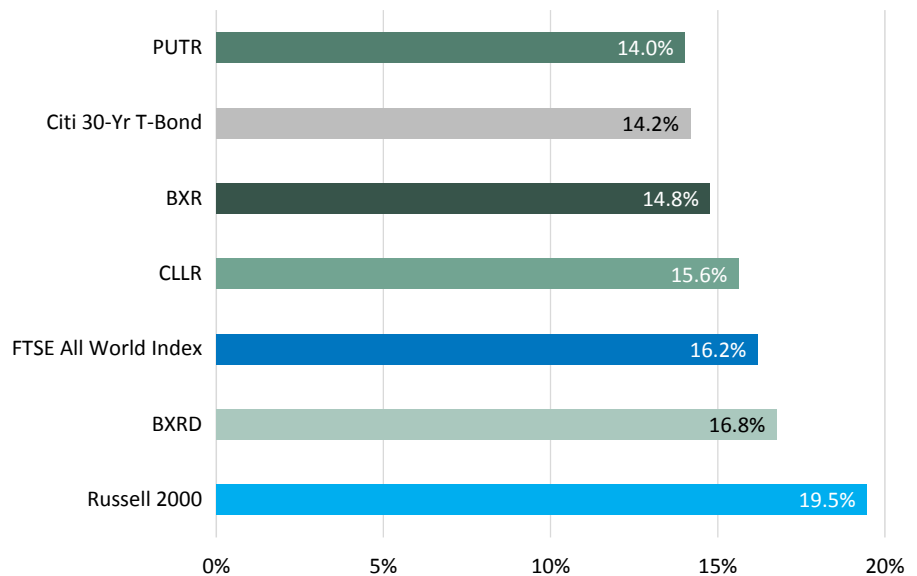


Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

PUTR had the highest return of all the indexes included. The exceptional return posted by the long-duration fixed income benchmark is largely the product of massive interest rate declines, particularly in the last few years of the study.

Annualized standard deviations of the CBOE Russell Options Indexes, Russell 2000, the FTSE All World Index and fixed income represented by the Citigroup 30-Year Treasury Bond Index. Data is from January 31, 2001 to July 31, 2016.

### EXHIBIT 8: ANNUALIZED STANDARD DEVIATIONS



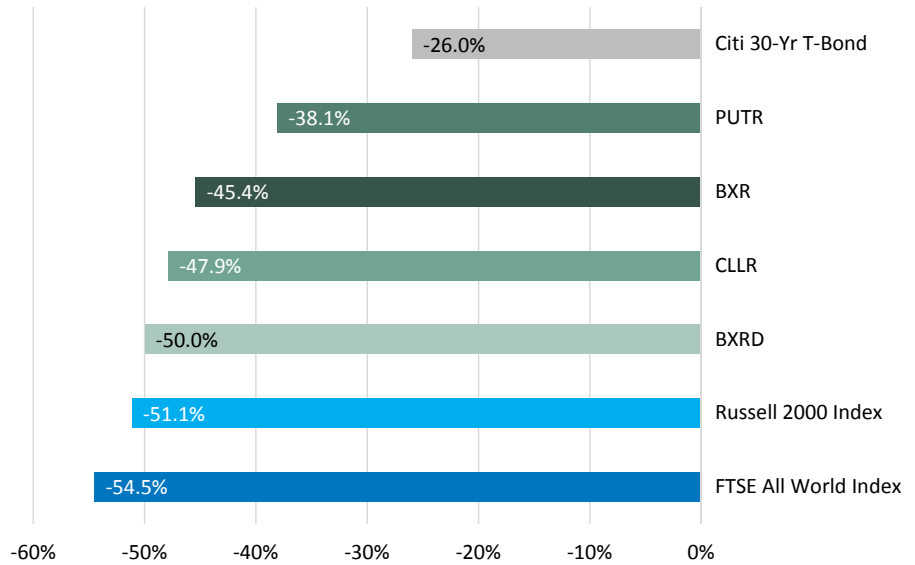
Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

While posting the highest returns of the group, PUTR also exhibited the lowest standard deviation—less volatile even than the fixed income benchmark. A factor that facilitated the strong performance of the PUTR Index was the volatility risk premium shown in Exhibit 1.

The options-writing indexes tend to have lower standard deviations compared to the long-only equity indexes.

Maximum Drawdown is an indicator of the worst peak-to-subsequent-trough loss each index experienced over the course of the study.

### EXHIBIT 9: MAXIMUM DRAWDOWNS

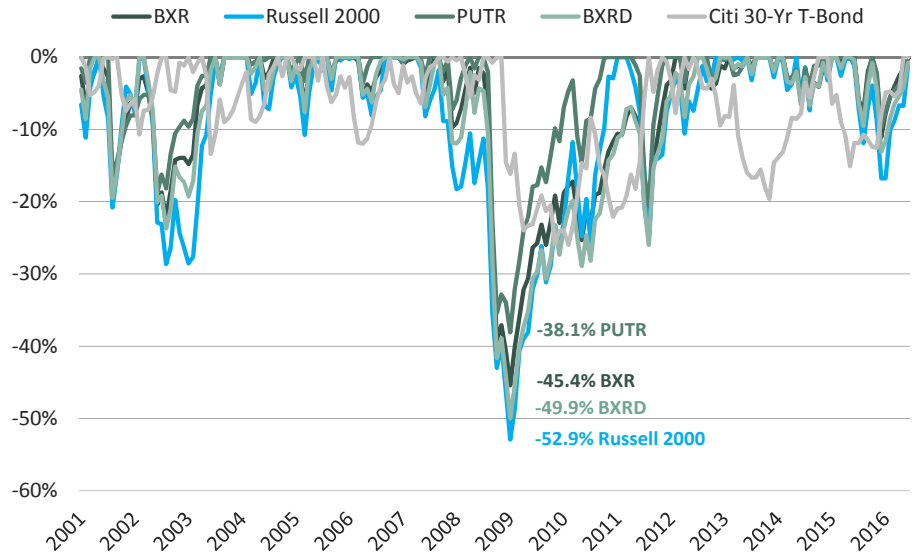


Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

With the exception of fixed income, all of the indexes experienced massive drawdowns during the credit crisis of 2008. The CBOE Russell 2000 Options Indexes, however, declined less than the long-only equity indexes during their most stressful periods.

Peak-to-trough drawdowns through time of the CBOE Russell Options Indexes, Russell 2000, and fixed income represented by the Citigroup 30-Year Treasury Bond Index.

### EXHIBIT 10: DRAWDOWNS

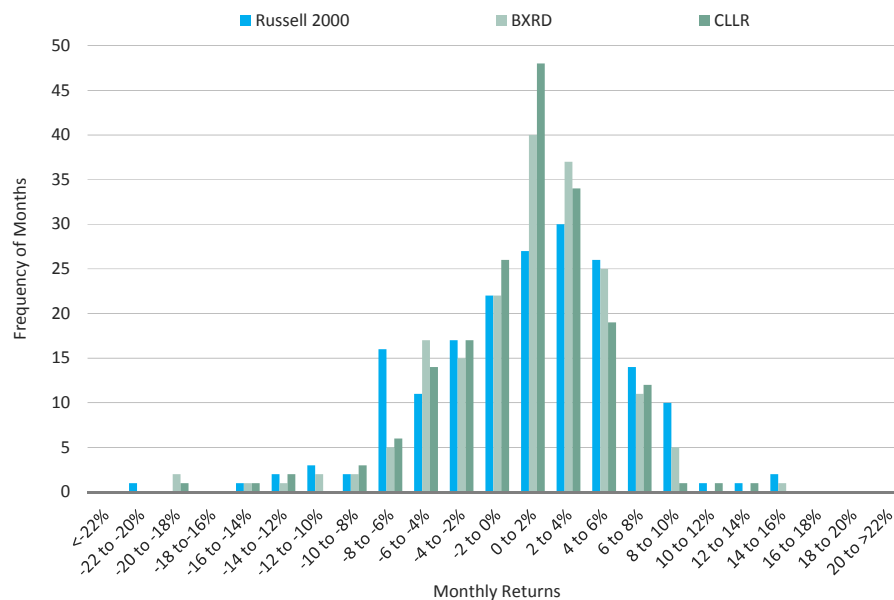


Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

The CBOE Russell Options Indexes exhibited a consistent pattern of declining in conjunction with the equity markets, although usually to a lesser degree.

Monthly return distribution comparison of the Russell 2000 Index vs. the CBOE Russell 2000 30-Delta BuyWrite Index (BXR) and the CBOE Russell 2000 Zero-Cost put Spread Collar Index (CLLR).

## EXHIBIT 11: MONTHLY RETURN DISTRIBUTIONS



Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

Relative to the Russell 2000 Index, the CBOE Russell 2000 Zero-Cost Spread Index (CLLR) posted nearly twice as many monthly returns between 0% and 2%, by far its highest frequency.

The option indexes' tail-risk hedging characteristics can be observed by the fact that the Russell 2000 lost 4% or more in 36 months over the course of the study compared to 30 months for the BXR and only 27 for the CLLR over the study period.

Of the options-writing indexes, PUTR had the highest return, lowest standard deviation, lowest maximum drawdown, shortest recovery, the highest Sharpe ratio, and highest Sortino ratio. However, PUTR also had the deepest negative skew and lowest S-ratio.

The beta of the options-writing indexes ranged from 0.59 to 0.81, exhibiting a fairly high correlation to the equity markets, particularly compared with the CitiGroup 30-Year Treasury Bond Index's -0.24 beta vs. the Russell 2000 Index.

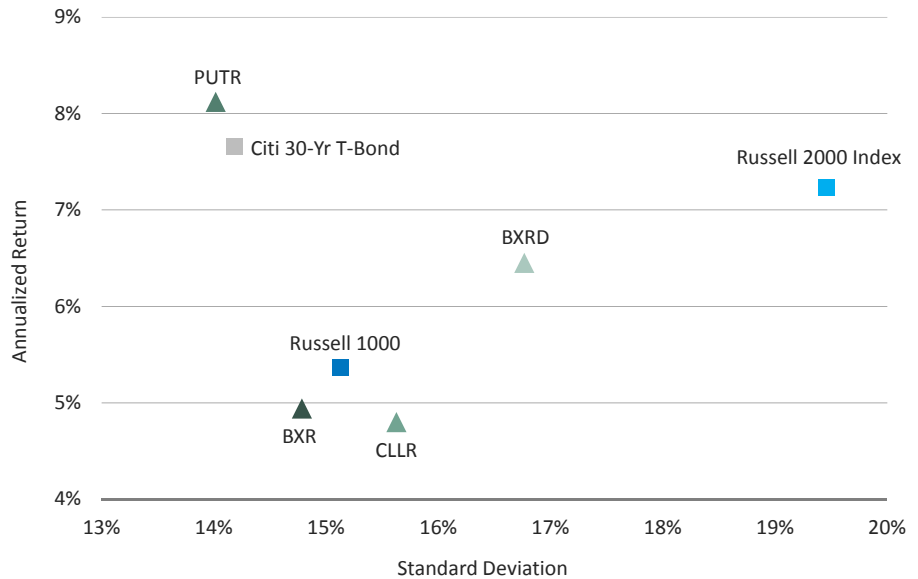
## EXHIBIT 12: SUMMARY STATISTICS

	CLLR	PUTR	BXR	BXR	Russell 2000	Russell 1000	FTSE All-World	Citi 30-Yr T-Bond
Annualized Return	4.8%	8.1%	6.5%	4.9%	7.2%	5.4%	4.9%	7.7%
Average Monthly Return	0.5%	0.7%	0.6%	0.5%	0.7%	0.5%	0.5%	0.7%
Monthly Standard Deviation	4.5%	4.1%	4.8%	4.3%	5.6%	4.4%	4.7%	4.1%
Annualized Standard Deviation	15.6%	14.0%	16.8%	14.8%	19.5%	15.1%	16.2%	14.2%
Beta vs. Market	0.78	0.59	0.81	0.67	1.00	0.70	0.72	-0.24
Max Drawdown	-47.9%	-38.1%	-50.0%	-45.4%	-52.9%	-51.1%	-54.5%	-26.0%
Max Recovery	26	22	42	37	24	37	50	18
Average Recovery	3.9	3.2	4.4	5.0	4.0	6.6	5.9	5.1
Max Monthly Return	12.5%	14.2%	14.2%	14.0%	15.5%	11.2%	12.1%	16.2%
Min Monthly Return	-18.9%	-20.9%	-19.5%	-19.0%	-20.8%	-17.5%	-19.9%	-14.6%
Average Positive Month	3.2%	2.5%	3.4%	2.8%	4.4%	3.1%	3.5%	3.2%
Average Negative Month	-3.9%	-3.8%	-4.3%	-3.7%	-4.7%	-3.9%	-3.7%	-2.9%
Positive Standard Deviation	2.4%	2.0%	2.4%	2.1%	3.0%	2.4%	2.6%	3.0%
Negative Standard Deviation	3.7%	4.5%	4.1%	4.1%	4.0%	3.3%	3.6%	2.5%
S-Ratio	0.66	0.43	0.58	0.50	0.77	0.74	0.73	1.18
Skewness	-0.89	-1.95	-1.09	-1.50	-0.52	-0.64	-0.67	0.32
Kurtosis	2.41	8.21	2.81	5.34	0.86	1.27	1.70	2.58
Sharpe Ratio (2.0%)	0.25	0.49	0.34	0.27	0.36	0.29	0.26	0.45
Sortino Ratio (1.0%)	0.32	0.63	0.42	0.34	0.44	0.39	0.33	0.74

A risk-free rate of 2% was utilized for the Sharpe ratio and 1% for the Sortino ratio. S-ratio = positive standard deviation/negative standard deviation. Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

Annualized returns and standard deviations for the CBOE Russell 2000 Options Indexes, the Russell 2000, the FTSE All World Index and fixed income represented by the Citigroup 30-Year Treasury Bond Index.

### EXHIBIT 13: RISK AND RETURN



Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

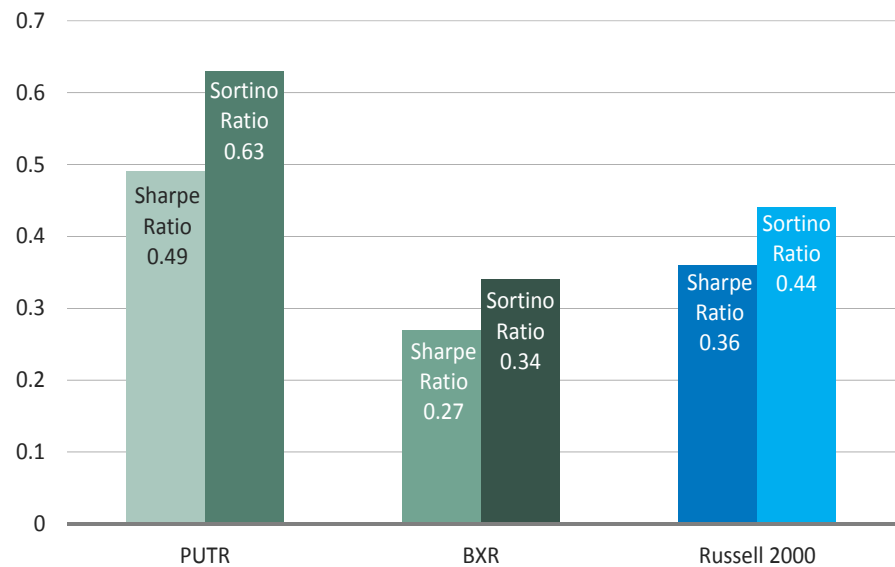
The CBOE Russell 2000 PutWrite Index posted the most favorable risk-adjusted returns during the period of study.

The Sharpe ratio = (return – risk free rate) / standard deviation.

The Sortino ratio = (return – minimum acceptable return) / semi-deviation.

The PUTR Index had higher Sharpe and Sortino ratios than the Russell 2000 Index, indicating that more average return was earned in excess of the risk-free rate per unit of volatility over the period of the study.

### EXHIBIT 14: RISK-ADJUSTED RETURNS



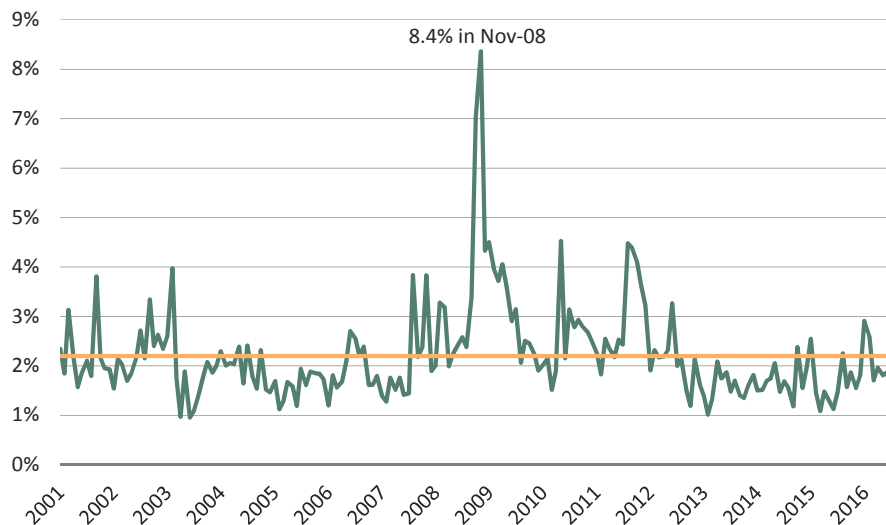
A risk-free rate of 2% was utilized for Sharpe ratio, and 1% for the Sortino ratio. Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

Risk-adjusted returns are imperfect when measuring non-normal distributions. The indexes listed above are negatively skewed, which means that extreme moves could be larger in magnitude on the downside than extreme moves to the upside.



Monthly premiums as a percentage of the underlying from 2001 to July 2016. Note that the net returns for the BXR Index can be negative and often have been less than the gross premiums received.

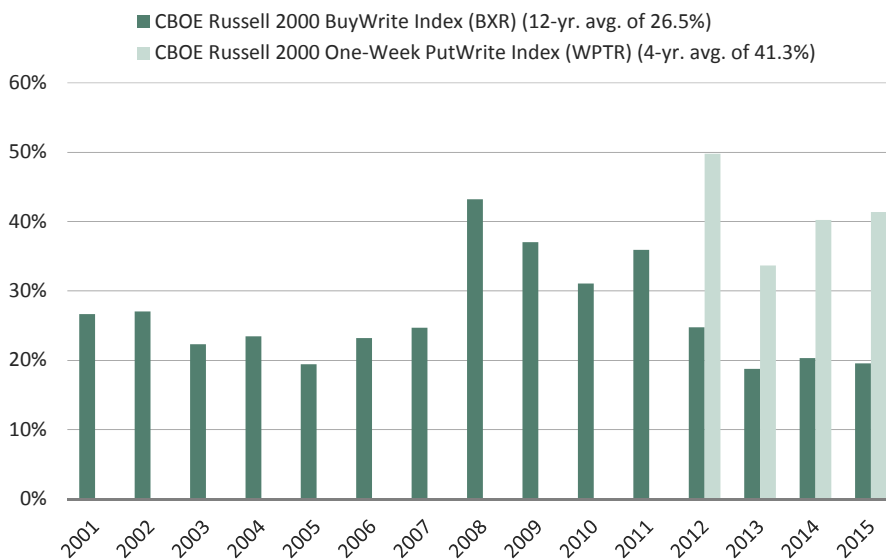
**EXHIBIT 15: MONTHLY GROSS PREMIUMS BY THE BXR INDEX**



Data Sources: Bloomberg, CBOE; data from January 2001 to July 2016

Aggregate gross premiums as a percentage of the underlying, received monthly by the BXR Index and weekly by the WPTR Index, from 2001 to 2015. Net returns often are lower than gross premiums received.

**EXHIBIT 16: ANNUAL AGGREGATE GROSS PREMIUMS**



Data Sources: Bloomberg, CBOE; data from January 2001 to December 2015

Although the effect would be lessened by the transaction costs, aggregating one year of weekly options yields greater gross premiums than one year of monthly options—evidence that the theta curve steepens as expiration nears.

**EXHIBIT 17: CALENDAR YEAR RETURNS FOR INDEXES**

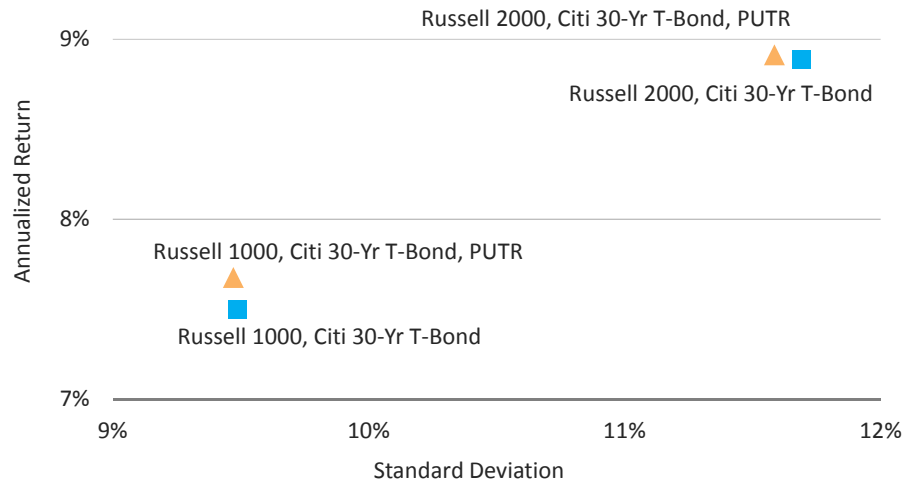
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Russell 2000	-20.5%	47.3%	18.3%	4.6%	18.4%	-1.6%	-33.8%	27.2%	26.9%	-3.7%	15.7%	38.8%	4.9%	-4.4%
BXR	-5.9%	32.0%	15.8%	5.0%	11.6%	5.8%	-36.0%	28.5%	7.5%	6.8%	9.0%	14.5%	0.9%	4.6%
BXRD	-10.1%	36.6%	16.7%	8.1%	24.8%	3.9%	-36.2%	25.4%	11.8%	3.3%	12.7%	20.6%	1.5%	1.5%
PUTR	-0.1%	23.8%	19.0%	8.3%	19.0%	16.1%	-28.5%	34.3%	13.8%	6.1%	10.4%	12.0%	3.9%	4.9%
WPTR	-	-	-	-	-	-	-	-	-	-	17.7%	13.0%	-2.9%	-0.9%

Data Sources: Bloomberg, CBOE; data from January 2002 to December 2015

Calendar year returns indicate that while gross premiums were positive, performance may have been negative in the same period.

Annualized risk and return impact of the inclusion of an options-based index to a traditional 60/40 portfolio such that the resulting allocations are 54% stocks, 36% T-bonds, and 10% PUTR.

### EXHIBIT 18: IMPACT OF A 10 PERCENT ALLOCATION TO AN OPTIONS-BASED INDEX



	Russell 1000, Citi 30-Yr T- Bond	With PUTR	Russell 2000, Citi 30-Yr T- Bond	With PUTR
Annualized Return	7.00%	7.18%	8.38%	8.41%
Standard Deviation	8.99%	8.97%	11.19%	11.09%

All indexes are a total return. Data Sources: Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

The graph illustrates the impact of adding a 10% allocation to the CBOE Russell 2000 PutWrite Index (PUTR) to two different otherwise naïve portfolios comprised of 60% stocks and 40% bonds—one with the Russell 1000 Index representing the equity portion of the pool, the other utilizing the Russell 2000 Index for stock exposure.

Although modest, the inclusion of the PUTR would have improved the risk-adjusted returns in both cases.

# Case Studies on Fund Use of Options: Part 1

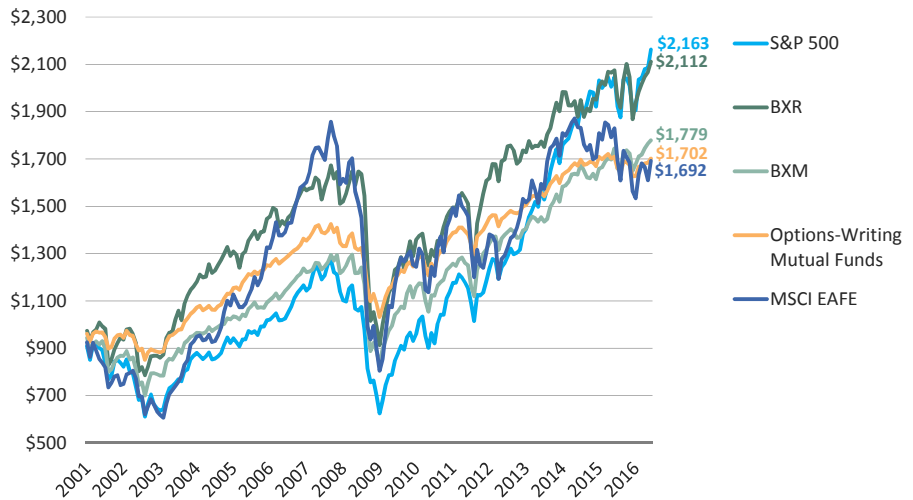
## Options-Writing Mutual Funds

An analysis of the performance of mutual funds in the "Option Writing" category that was introduced by Morningstar in April 2016 was performed. The number of funds analyzed grew to 29 in 2016.

The prospective return (including reinvestment of dividends but gross of fees) of a \$1,000 investment initiated in each of the indexes and a group of options-writing mutual funds beginning January 2001.

Performance of the group of 29 funds was based upon an equal weighting of each.

**EXHIBIT 19: GROWTH OF \$1,000**



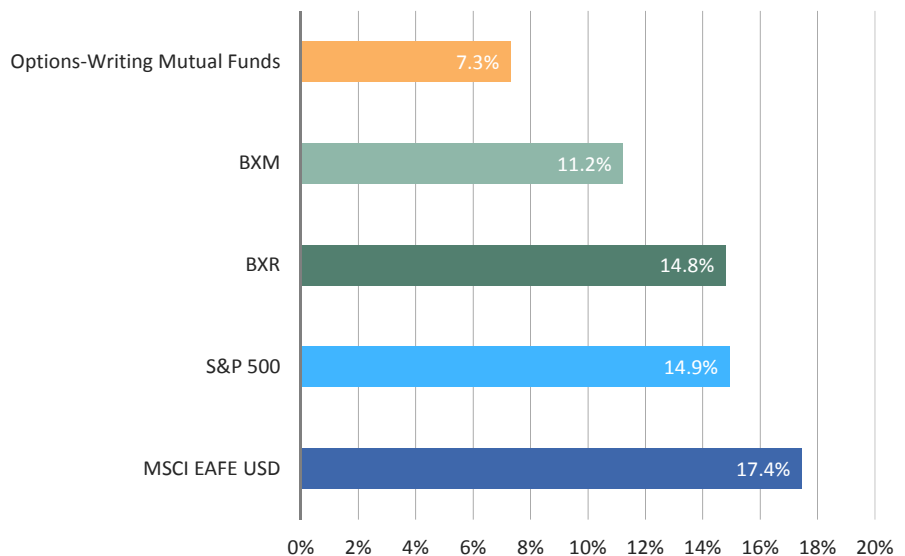
The inclusion of references to money managers in this paper should not be construed as an endorsement or an indication of the value of any product, security, fund, service, or other website. Such managers and their financial products are not sponsored, endorsed, sold or promoted by CBOE or FEG. Data Sources: Morningstar, Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

The group of option-writing mutual funds had been outperforming the CBOE S&P 500 BuyWrite Index (BXM) throughout much of the study while tracking it fairly closely. The majority of the strategies included in the Morningstar option-writing category are appropriately benchmarked against the BXM.

Standard deviation of a group of option-writing mutual funds vs. buy-write, long-only equity, and fixed income indexes.

The group of options-writing mutual funds exhibited far less standard deviation than any of the indexes over the course of the study.

**EXHIBIT 20: STANDARD DEVIATIONS**



Data Sources: Morningstar, Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

The group of funds is not perfectly homogeneous, which likely resulted in a Modern-Portfolio-Theory type of volatility reduction when evaluating aggregate returns.

Statistical summary of the group of option-writing mutual funds vs. various indexes.

The returns produced by the group of option-writing mutual funds exhibited less risk than the indexes. Standard deviation, max drawdown, average negative month, and negative standard deviation were all lower than the benchmarks.

## EXHIBIT 21: SUMMARY STATISTICS

	Options-Writing Mutual Funds	BXR	BXM	S&P 500	MSCI EAFE
Annualized Return	3.5%	4.9%	3.8%	5.1%	3.5%
Average Monthly Return	0.3%	0.5%	0.4%	0.5%	0.4%
Monthly Standard Deviation	2.1%	4.3%	3.2%	4.3%	5.0%
Annualized Standard Deviation	7.3%	14.8%	11.2%	14.9%	17.4%
Beta vs. Market	0.33	0.67	0.46	0.68	0.72
Max Drawdown	-27.5%	-45.4%	-35.8%	-51.0%	-56.7%
Max Recovery	35	37	34	37	64
Average Recovery	3.5	5.0	5.4	6.7	10.8
Max Monthly Return	5.9%	14.0%	10.0%	10.9%	12.8%
Min Monthly Return	-8.4%	-19.0%	-15.1%	-16.8%	-20.2%
Average Positive Month	1.5%	2.8%	2.0%	3.1%	3.8%
Average Negative Month	-1.9%	-3.7%	-2.9%	-3.8%	-4.0%
Positive Standard Deviation	1.1%	2.1%	1.7%	2.4%	2.7%
Negative Standard Deviation	1.7%	4.1%	3.1%	3.2%	3.7%
S-Ratio	0.65	0.50	0.55	0.75	0.73
Skewness	-0.82	-1.50	-1.17	-0.62	-0.64
Kurtosis	0.02	5.34	3.99	0.01	0.01
Sharpe Ratio (2.0%)	0.24	0.27	0.21	0.28	0.17
Sortino Ratio (1.0%)	0.46	0.34	0.32	0.38	0.19

Data Sources: Morningstar, Bloomberg, CBOE; data from January 31, 2001 to July 31, 2016

The group of mutual funds trailed the long-only equity benchmarks returns during a period of strong stock market performance. When combined with the lower risk profile of the group, risk-adjusted return metrics were comparable between the funds and the benchmarks.

There were 29 options-writing mutual funds, as indicated by Morningstar, with available data, that were included in the analysis.

## EXHIBIT 22: OPTIONS-WRITING MUTUAL FUNDS

Mutual Funds	Ticker
AllianzGI Structured Return A	AZIAX
AllianzGI US Equity-Hedged A	AZUAX
ASTON/Anchor Capital Enhanced Equity N	AMBEX
BPV Wealth Preservation Instl	BPVPX
Bridgeway Managed Volatility	BRBPX
Calamos Hedged Equity Income A	CAHEX
Crow Point Defined Risk Global Eq Inc A	CGHAX
Eaton Vance Hedged Stock A	EROAX
Gateway A	GATEX
Gateway Equity Call Premium A	GCPAX
Glenmede International Secured Opts	NOVIX
Glenmede Secured Options	GTSOX
Hatteras Disciplined Opportunity Instl	HDOIX
Iron Horse A	IRHAX
Ironclad Managed Risk	IRONX
JHancock Redwood NAV	JTRAX
JPMorgan Hedged Equity A	JHQAX
KKM Enhanced US Equity A	KKMAX
Leigh Baldwin Total Return	LEBOX
LS Theta Institutional	LQTIX
M.D. Sass Equity Income Plus Instl	MDEIX
Madison Covered Call & Equity Income A	MENAX
MAI Managed Volatility Institutional	MAIPX
Main BuyWrite I	BUYWX
RiverPark Structural Alpha Institutional	RSAIX
Schooner A	SCNAX
Stadion Alternative Income A	TACFX
TCW Gargoyle Hedged Value I	TFHIX
Touchstone Dynamic Equity Y	TDEYX

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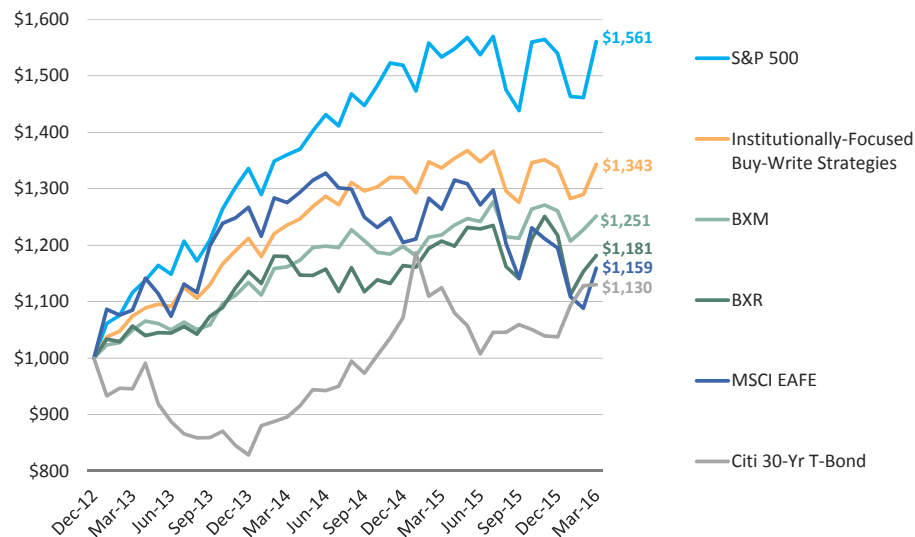
## Case Studies on Fund Use of Options: Part 2

### Institutionally-Focused Buy-Write Strategies

The prospective return (including reinvestment of dividends but gross of fees) of a \$1,000 investment in an equally-weighted group of institutionally-focused buy-write strategies vs. various options-based, long-only equity, and fixed income indexes.

Performance of the group of 26 funds was based upon an equal weighting of each.

EXHIBIT 23: GROWTH OF \$1,000



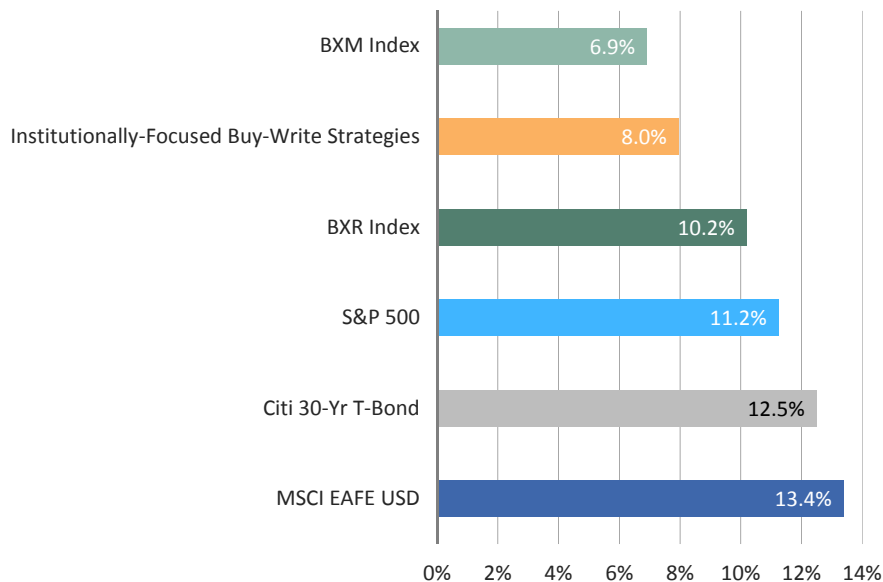
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The aggregate returns of the institutional buy-write strategies outperformed all of the indexes other than the S&P 500 Index® over the course of the study (December 2012 through March 2016).

Standard deviation of the group of institutionally-focused buy-write strategies vs. buy-write, long-only equity, and fixed income indexes.

Performance of the institutional buy-write strategies exhibited slightly higher standard deviation than the BXM, but less so than the other indexes.

EXHIBIT 24: STANDARD DEVIATIONS



Data Sources: eVestment, Bloomberg, CBOE; data from December 31, 2012 to March 31, 2016

The higher standard deviation of the institutional buy-write strategies compared to the BXM may be explained by a volatility reduction effect observed when combining a group of investments that are not perfectly correlated with one another.

Statistical summary of the group of institutionally-focused buy-write strategies vs. various indexes.

Annualized returns for the group of institutionally-focused buy-write managers were higher than all but the S&P 500 and the max drawdown was more shallow than all but the CBOE S&P 500 BuyWrite Index (BXM).

**As a group, the institutionally-focused buy-write strategies posted strong risk-adjusted returns relative to the indexes.**

## EXHIBIT 25: SUMMARY STATISTICS

	Institutionally-Focused Buy-Write Strategies	BXR	BXM	S&P 500	MSCI EAFE	Citi 30-Yr T-Bond
<b>Annualized Return</b>	9.5%	5.0%	7.1%	14.4%	3.6%	4.6%
<b>Average Monthly Return</b>	0.8%	0.5%	0.6%	1.2%	0.4%	0.4%
<b>Monthly Standard Deviation</b>	2.3%	2.9%	2.0%	3.2%	3.9%	3.6%
<b>Annualized Standard Deviation</b>	8.0%	10.2%	6.9%	11.2%	13.4%	12.5%
<b>Beta vs. Market</b>	0.42	0.57	0.29	0.61	0.57	-0.26
<b>Max Drawdown</b>	-6.7%	-11.1%	-5.4%	-8.4%	-18.0%	-16.4%
<b>Max Recovery</b>	-	-	-	-	-	8
<b>Average Recovery</b>	1.1	2.3	2.0	1.1	1.8	4.0
<b>Max Monthly Return</b>	5.5%	6.2%	4.3%	8.4%	7.8%	10.8%
<b>Min Monthly Return</b>	-5.2%	-8.6%	-4.8%	-6.0%	-7.4%	-7.3%
<b>Average Positive Month</b>	2.1%	2.6%	1.7%	3.1%	3.6%	2.8%
<b>Average Negative Month</b>	-1.8%	-2.0%	-1.5%	-2.3%	-2.7%	-2.6%
<b>Positive Standard Deviation</b>	1.4%	1.4%	1.2%	2.0%	2.5%	2.5%
<b>Negative Standard Deviation</b>	1.5%	2.3%	1.4%	1.7%	2.1%	2.2%
<b>S-Ratio</b>	0.93	0.59	0.81	1.22	1.21	1.17
<b>Skewness</b>	-0.41	-0.86	-0.58	-0.08	0.14	0.25
<b>Kurtosis</b>	0.30	1.36	0.83	-0.25	-0.50	0.78
<b>Sharpe Ratio (2.0%)</b>	0.94	0.34	0.74	1.08	0.18	0.27
<b>Sortino Ratio (1.0%)</b>	1.74	0.55	1.37	2.09	0.31	0.45

Data Sources: Bloomberg, CBOE; data from December 31, 2012 to March 31, 2016

The skewness of the group of managers was negative but not as deep as the two buy-write benchmarks and both the Sharpe and Sortino ratios were higher than all but that posted by the S&P 500.

Managers in the institutionally-focused buy-write group included those that could be identified as employing a U.S.-focused buy-write strategy as a primary aspect of their investment philosophy, process, or portfolio construction as described in their eVestment product or fund narratives, with a track record that began on or before December 2012 and was updated in the eVestment database through March 2016.

This list of managers is not exhaustive as there are limitations to the screening process. Managers not included in the eVestment database, which served as the source for this case study, may include Russell Investments, Chicago Equity Partners, Connors Investment Services, Courtland, and Morgan Creek. Reports in recent years indicate that options-based strategies have received significant allocations from pension funds<sup>4</sup>.

## EXHIBIT 26: INSTITUTIONALLY-FOCUSED BUY-WRITE STRATEGIES

Manager	Strategy
1492 Capital Management, LLC	Small Cap Dynamic Hedge
Allianz Global Investors	AllianzGI Structured Alpha Equity 250
Allianz Global Investors	AllianzGI Structured Alpha Equity 500
Analytic Investors, LLC	Covered Call
Chartwell Investment Partners	Chartwell Covered Call Strategy
First Quadrant L.P.	Protected Equity Plus
Flippin, Bruce & Porter, Inc.	FBP Equity and Dividend Plus
Gateway Investment Advisers, LLC	Gateway Active Index Option Overwrite Composite
Gateway Investment Advisers, LLC	Gateway Buy-Write Replication Composite
Gateway Investment Advisers, LLC	Gateway Index/RA (Risk Adjusted)
Geode Capital Management, LLC	Geode OPT-Premia Spread
Glenmede Investment Management LP	Secured Options
Harvest Volatility Advisors	Long Short Replication Equity Hedge
Iron Financial LLC	IRON S&P 500 Equity Plus Strategy
M.D. Sass Investors Services and Associates	M.D. Sass Equity Income Plus
MAI Capital Management, LLC	MAI Managed Volatility Strategy
Parametric Portfolio Associates, LLC	Parametric Defensive Equity
The Pelican Bay Group	Yield Plus Covered Calls
Putnam Investments	Putnam Strategic Volatility Equity
Putnam Investments	Putnam U.S. Low Volatility Equity
Schafer Cullen Capital Management	Enhanced Equity Income
Shelton Capital Management	Equity Income Strategy
Sterling Capital Management LLC	Sterling Enhanced Equity SMA
Van Hulzen Asset Management	Van Hulzen Covered Call Strategy
Willingdon Wealth Management	Willingdon Covered Call Portfolio
Ziegler Capital Management LLC	FAMCO Covered Call

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Source: eVestment.

<sup>4</sup> Sources include: Pensions & Investments (P&I) Articles Published March 21, 2016 and April 21, 2016, and Standard & Poor's Money Market Directories (MMD).

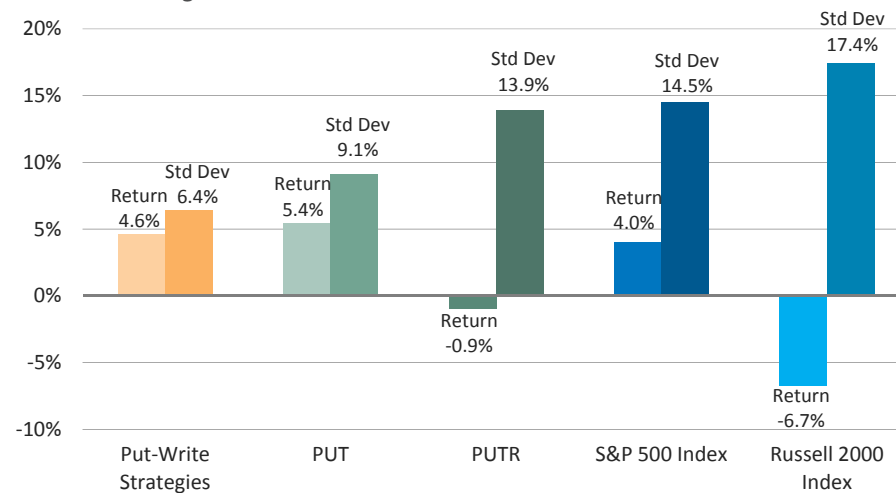
## Case Studies on Fund Use of Options: Part 3

### Institutionally-Focused Put-Write Strategies

Institutionally-focused managers who employ put selling in U.S. markets were analyzed. Five strategies were identified that met the study criteria. Given the scarcity of strategies and the limited track record posted by most of them, a detailed analysis of performance would not have yielded meaningful results.

*Return and standard deviation of an equally-weighted portfolio of the five put-writing managers (Put-Write Strategies) vs. the S&P 500 PutWrite Index (PUT), the CBOE Russell 2000 PutWrite Index (PUTR), the S&P 500 Index, and the Russell 2000 Index.*

**EXHIBIT 27: RETURN AND STANDARD DEVIATION**  
One-Year Ending June 2016



Data Sources: eVestment, Bloomberg, CBOE; data from December 31, 2012 to June 30, 2016

Recognizing the small sample size and short period of analysis, **the outperformance with lower volatility posted by the group of institutionally-focused put-writing managers relative to long-only equity indexes echoes the analysis earlier in this report** that described the strong long-term returns of the CBOE Russell 2000 PutWrite Index (PUTR) vs. the Russell 2000 Index.

The aggregate return of the put-writing managers was nearly as positive as the CBOE S&P 500 PutWrite Index (PUT), which posted the strongest return in the analysis. The Russell 2000 Index underperformed the S&P 500 Index by an uncharacteristically large amount, which impacted the relative performance between PUTR and PUT. **The risk-reducing characteristics of PUTR vs. the Russell 2000 Index described earlier were evident** during the study period.

*Institutionally-focused put-write strategies were screened by the product/fund narratives in the eVestment database seeking managers with a stated put-writing mandate and/or the selection of a PutWrite index as the strategy's primary performance benchmark.*

*This list of managers is not exhaustive as there are limitations to the screening process. Managers not included in the eVestment database, which served as the source for this case study, may include Russell Investments, AQR, SSgA, and UBS. Reports in recent years indicate that options-based strategies have received significant allocations from pension funds<sup>5</sup>.*

**EXHIBIT 28: INSTITUTIONALLY-FOCUSED PUT-WRITE STRATEGIES**

Manager	Strategy
DGV Solutions	DGV Enhanced U.S. Equity Fund, LLC
Gateway Investment Advisors	Gateway Active Index PutWrite Composite
Morgan Stanley Investment Management	Global Balanced Income
Neuberger Berman	S&P 500 PutWrite (OTM)
Parametric Portfolio Associates	Parametric Liquid Alternative

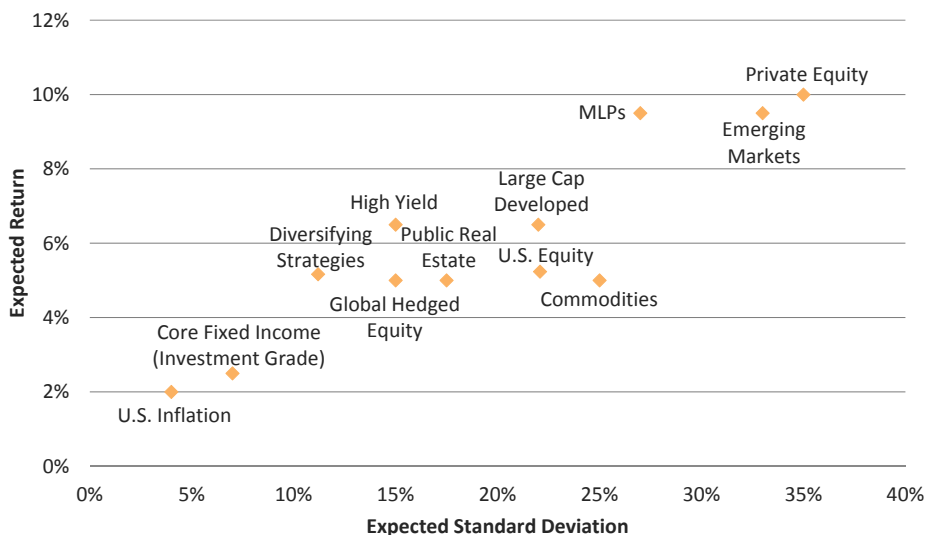
*The inclusion of references to money managers in this paper should not be construed as an endorsement or an indication of the value of any product, security, fund, service, or other website. Such managers and their financial products are not sponsored, endorsed, sold or promoted by CBOE or FEG. Source: eVestment*

<sup>5</sup> Sources include: Pensions & Investments (P&I) Articles Published March 21, 2016 and April 21, 2016, and Standard & Poor's Money Market Directories (MMD).

## Appendix

FEG's capital market assumptions reflect our risk and return expectations for various asset categories over the subsequent decade. The methods used vary by asset class and incorporate assumptions for return, standard deviation and covariance. The assumptions are derived from both historical data and forecasts for the future based in part upon current metrics such as valuations, yield, etc. to arrive at forward-looking projections.

**EXHIBIT 29: FEG 10-YEAR CAPITAL MARKET ASSUMPTIONS**



Source: FEG; Assumptions are as December 31, 2015.

For most traditional asset classes, FEG's return expectation for the future falls well below the historical average. If such a low-return environment were to develop, differentiated performance characteristics like those exhibited by the CBOE Russell 2000 Option Indexes, as well as other options-based strategies that derive return from the volatility risk premium, could enhance an investment portfolio's risk-adjusted returns.



## EXHIBIT 30: INDEX DESCRIPTIONS

TICKER	DESCRIPTION	Change for Total Return Indexes in Recent Years							
		2008	2009	2010	2011	2012	2013	2014	2015
<b>BXR</b>	CBOE Russell 2000 BuyWrite Index is a benchmark index that measures the performance of a theoretical portfolio that sells Russell 2000 Index (RUT) call options every month, against a portfolio of the stocks included in the Russell 2000 Index.	-36.0%	28.5%	7.5%	6.8%	9.0%	14.5%	0.9%	4.6%
<b>CLLR</b>	CBOE Russell 2000 Zero-Cost Put Spread Collar Index is designed to track the performance of a hypothetical option trading strategy that 1) holds a long position indexed to the Russell 2000 Index; 2) on a monthly basis buys a 2.5 percent to 5 percent Russell 2000 Index put option spread; and 3) sells a monthly out-of-the-money (OTM) Russell 2000 Index call option to cover the cost of the put option spread. The CLLR Index rolls on a monthly basis, typically every third Friday of the month.	-33.5%	27.1%	15.2%	1.7%	12.7%	20.5%	4.2%	-1.8%
<b>BXRD</b>	CBOE Russell 2000 30-Delta BuyWrite Index is designed to track the performance of a hypothetical covered call strategy that holds a long position indexed to the Russell 2000 Index and sells a monthly out of the money (OTM) Russell 2000 Index call option. The call option written is the strike nearest to the 30 Delta at 10:00 a.m. CT on the Roll Date. The BXRD Index rolls on a monthly basis, typically every third Friday of the month.	-36.2%	25.4%	11.8%	3.3%	12.7%	20.6%	1.5%	1.5%
<b>BXRC</b>	CBOE Russell 2000 Conditional BuyWrite Index is designed to track the performance of a hypothetical covered call strategy that holds a long position indexed to the Russell 2000 Index and sells a monthly at-the-money (ATM) Russell 2000 Index call option. The written number of ATM call options will be either ½ unit or one unit and will be determined by the level of the CBOE Russell Volatility Index (RVX Index) when the call option is written on the Roll Date. The BXRC Index rolls on a monthly basis, typically every third Friday of the month.	-36.4%	28.7%	7.5%	6.8%	9.3%	16.4%	1.5%	1.7%
<b>PUTR</b>	CBOE Russell 2000 PutWrite Index is designed to track the performance of a hypothetical strategy that sells a monthly at-the-money (ATM) Russell 2000 Index put option. The written Russell 2000 put option is collateralized by a money market account invested in one month Treasury bills. The PUTR Index rolls on a monthly basis, typically every third Friday of the month.	-28.5%	34.3%	13.8%	6.1%	10.4%	12.0%	3.9%	4.9%
<b>WPTR</b>	CBOE Russell 2000 One-Week PutWrite Index is designed to track the performance of a hypothetical strategy that sells an ATM Russell 2000 Index put option on a weekly basis. The maturity of the written Russell 2000 put option is one week to expiry. The written Russell 2000 put option is collateralized by a money market account invested in one-month Treasury bills. The WPTR Index rolls on a weekly basis, typically every Friday.	-	-	-	-	17.7%	13.0%	-2.9%	-0.9%
<b>RUT</b>	The Russell 2000 Index is a small-cap stock market index of the 2,000 smallest stocks in the Russell 3000 Index.	-33.8%	27.2%	26.9%	-3.7%	15.7%	38.8%	4.9%	-4.4%
<b>BXM</b>	CBOE S&P 500 Buy Write Index - tracks the performance of a hypothetical option trading strategy that purchases stocks in the S&P 500 index, and each month sell at-the-money (ATM) SPX index call options.	-32.1%	26.7%	6.4%	6.2%	5.7%	14.4%	6.0%	5.6%

Source: CBOE. See continued index descriptions on page 18.

### INDEX DESCRIPTIONS

**The CBOE Russell 2000 Volatility Index (RVX)** is a key measure of market expectations of near-term volatility conveyed by Russell 2000® stock index option prices. It measures the market's expectation of 30-day volatility implicit in the prices of near-term Russell 2000 options.

**The CBOE S&P 500 PutWrite Index (PUT)** is a benchmark index that measures the performance of a hypothetical portfolio that sells S&P 500 Index (SPX) put options against collateralized cash reserves held in a money market account. The PUT strategy is designed to sell a sequence of one-month, at-the-money, S&P 500 Index puts and invest cash at one- and three-month Treasury Bill rates.

**The CBOE Volatility Index (VIX)** is an up-to-the-minute market estimate of expected volatility that is calculated by using real-time S&P 500 Index option bid/ask quotes. The Index uses nearby and second nearby options with at least 8 days left to expiration and then weights them to yield a constant, 30-day measure of the expected volatility of the S&P 500 Index.

The **Citigroup 30-Year Treasury Bond Index** is composed of all U.S. Treasury notes and bonds with remaining maturities of at least one year and outstanding principal of at least \$25 million that are included in the Citigroup Broad Investment-Grade Bond Index



## INDEX DESCRIPTIONS (CONTINUED)

The **FTSE All-World Index** is a market-capitalisation weighted index representing the performance of the large and mid cap stocks from the FTSE Global Equity Index Series and covers 90-95% of the investable market capitalization.

The **MSCI EAFE (Europe, Australasia, Far East) Index** is a free float-adjusted market capitalization index that is designed to measure the equity market performance of developed markets, excluding the US & Canada.

The **Russell 1000 Index** measures the performance of the large-cap segment of the U.S. equity universe. It is a subset of the Russell 3000<sup>®</sup> Index and includes approximately 1000 of the largest securities based on a combination of their market cap and current index membership. The Russell 1000 represents approximately 92% of the U.S. market. The Russell 1000 Index is constructed to provide a comprehensive and unbiased barometer for the large-cap segment and is completely reconstituted annually to ensure new and growing equities are reflected.

The **S&P 500 Index (SPX)** is capitalization-weighted index of 500 stocks. The S&P 500 Index is designed to measure performance of the broad domestic economy through changes in the aggregate market value of 500 stocks representing all major industries.

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Past performance is not indicative of future results.

This report contains hypothetical backtested performance represented by the index in each asset class. As such, the returns shown in the chart are those of the indices. The results do not necessarily represent the actual asset allocation of any client or investor portfolio and may not reflect the impact that material economic and market factors might have had on investment decisions. Investment results achieved by actual client accounts may differ from the results portrayed. Diversification or asset allocation does not assure or guarantee better performance and cannot eliminate risk of investment loss. Investments cannot be made directly in an index. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. Hypothetical performance results are presented for illustrative purposes only. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the hypothetical returns presented.

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Expected returns on page 16 are forecasted net of fees based on asset category and any return expectations provided are not intended as, and must not be regarded as, a representation, warranty or predication that the investment will achieve any particular rate of return over any particular time-period or those investments will not incur losses. FEG Capital Market Assumptions are the result of a hypothetical allocation of actual investments constructed under assumption of various constraints and liquidity needs, and allocations may not be appropriate for all investment objectives. The results do not necessarily represent the actual asset allocation of any client portfolio and may not reflect the impact that material economic and market factors might have had on investment decisions. Investment results achieved by actual client accounts may differ from the results portrayed.

This report is prepared for informational purposes only. It does not address specific investment objectives, or the financial situation and the particular needs of any person who may receive this report.

Standard Deviation – A measure of variability in returns. The annual standard deviation measures the dispersion of annual returns around the average annualized return.

Index performance results do not represent any portfolio returns. An investor cannot invest directly in a presented index, as an investment vehicle replicating an index would be required. An index does not charge management fees or brokerage expenses, and no such fees or expenses were deducted from the performance shown.

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